

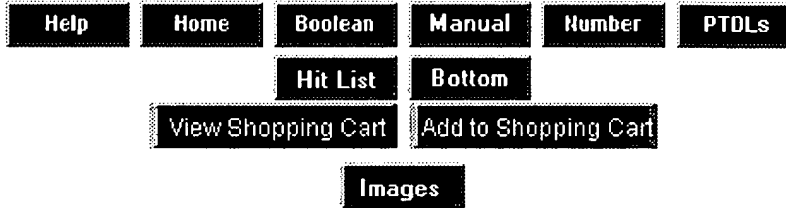
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10	0	6482224.URPN.	USPAT	2003/12/22 08:33
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19	602	((606/232).CCLS.) and suture	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:37
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21	8	(((((606/232).CCLS.) and suture) and staple) and valve	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:39
22	3105	(128/898).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:39
23	51	((128/898).CCLS.) and annuloplasty	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:39
24	18	((((128/898).CCLS.) and annuloplasty) and staple	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:41
25	286	((128/898).CCLS.) and staple	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:43
26	107	((((128/898).CCLS.) and staple) and valve	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:41
27	687	((606/157) or (606/158)).CCLS.	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:43
28	215	((((606/157) or (606/158)).CCLS.) and suture	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:43
29	137	(((((606/157) or (606/158)).CCLS.) and suture) and clip	USPAT; US-PGPUB; EPO; JPO; DERWENT	2003/12/22 08:44

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PATENT APPLICATION FULL TEXT AND IMAGE DATABASE



(1 of 1)

United States Patent Application**20020042621****Kind Code****A1****Liddicoat, John R. ; et al.****April 11, 2002**

Automated annular plication for mitral valve repair

Abstract

A novel system for performing a heart valve annuloplasty. The system involves the use of a plication band. In one embodiment, the annulus of the valve is reduced by constriction of the plication band itself. More particularly, each plication band enters the tissue at two or more points which are spaced from one other by a distance which is dictated by the geometry of the plication band. Subsequent constriction of the plication band causes these points to move toward each other, thereby constricting the tissue trapped between these points and thus reducing the overall circumference of the valve annulus. In a second embodiment, the annulus of the valve is reduced by linking multiple plication bands to one other, using a linkage construct, and then using a shortening of the length of the linkage construct between each plication band so as to gather the tissue between each plication band, whereby to reduce the overall circumference of the valve annulus.

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Claims

What is claimed is:

1. Apparatus for effecting a desired geometric change in the annulus of a heart valve, said apparatus comprising: a plication band comprising: first and second legs each having a first end, said first ends of said first and second legs having a tissue piercing configuration; and a bridge having first and second ends, said first end of said bridge being connected to said first leg and said second end of said bridge being connected to said second leg such that said first ends of said first and second legs are separated by a first given distance; said bridge being configured such that when said first ends of said first and second legs have pierced tissue at said first given distance, said bridge may be deformed so as to cause said first ends of said first and second legs to move toward one another so as to thereafter be separated by a second, shorter given distance, whereby said first and second legs gather together the pierced tissue to effect a desired geometric change in the annulus of the heart valve.
2. Apparatus according to claim 1 wherein said bridge may be deformed so as to cause said first ends to point in opposition to one another.
3. Apparatus according to claim 1 wherein said bridge further comprises a through-hole for receiving a linking construct whereby said plication band may be linked to an adjacent plication band.
4. Apparatus according to claim 3 wherein said bridge is crimpable so as to capture said linking construct within said through-hole.
5. Apparatus according to claim 3 wherein said through-hole has a circular configuration so as to receive a round filament.
6. A plication band according to claim 3 wherein said through-hole has a elongated configuration so as to receive a flat strap.
7. Apparatus for effecting a desired geometric change the annulus of a heart valve, said apparatus comprising: first and second plication bands, each said plication band comprising: first and second legs each having a first end, said first ends of said first and second legs having a tissue piercing configuration; and a bridge having first and second ends, said first end of said bridge being connected to said first leg and said second end of said bridge being connected to said second leg such that said first ends of said first and second legs are separated by a first given distance; said bridge being configured such that when said first ends of said first and second legs have pierced tissue at said first given distance, said bridge may be deformed so as to cause said first ends of said first and second legs to move toward one another so as to thereafter be separated by a second, shorter given distance, whereby said first and second legs gather together the pierced tissue to effect a desired geometric change in the annulus of the heart valve; and a linking construct connected to said first and second plication bands.

8. Apparatus according to claim 7 wherein the bridge of each plication band may be deformed so as to cause said first ends of that plication band to point in opposition to one another.
9. Apparatus according to claim 7 wherein the bridge of each plication band further comprises a through-hole for receiving said linking construct.
10. Apparatus according to claim 9 wherein the bridge of each plication band is crimpable so as to capture said linking construct within said through-hole.
11. Apparatus according to claim 9 wherein said linking construct comprises a round filament, and further wherein said through-holes have a circular configuration so as to receive said round filament.
12. Apparatus according to claim 9 wherein said linking construct comprises a flat strap, and further wherein said through-holes have an elongated configuration so as to receive said flat strap.
13. Apparatus according to claim 7 wherein said linking construct comprises a resilient material.
14. Apparatus according to claim 7 wherein said linking construct comprises a formable material such that said formable material can be set into a desired shape.
15. Apparatus according to claim 7 wherein said linking construct is permanently connected to said first and second plication bands.
16. Apparatus according to claim 7 wherein said linking construct comprises a linear linkage extending between said first and second plication bands.
17. Apparatus according to claim 7 wherein said linking construct comprises a linkage strip extending between said first and second plication bands.
18. Apparatus according to claim 7 wherein said linking construct comprises a linkage rod extending between said first and second plication bands.
19. A method for reducing the circumference of the annulus of a heart valve, said method comprising the steps of: providing apparatus for effecting a desired geometric change in the annulus of a heart valve, said apparatus comprising: a plication band comprising: first and second legs each having a first end, said first ends of said first and second legs having a tissue piercing configuration; and a bridge having first and second ends, said first end of said bridge being connected to said first leg and said second end of said bridge being connected to said second leg such that said first ends of said first and second legs are separated by a first given distance; said bridge being configured such that when said first ends of said first and second legs have pierced tissue at said first given distance, said bridge may be deformed so as to cause said first ends of said first and second legs to move toward one another so as to thereafter be separated by a second, shorter given distance, whereby said first and second legs gather together the pierced tissue to effect a desired geometric change in the annulus of the heart valve; and deploying the plication band into the annulus of the heart valve so as to reduce the circumference of the heart valve.
20. A method according to claim 19 wherein said apparatus comprises a plurality of plication bands, with said plurality of plication bands being sequentially deployed into the annulus of heart valve.
21. A method for reducing the circumference of the annulus of a heart valve, said method comprising the steps of: providing apparatus for effecting a desired geometric change in the annulus of a heart valve, said

apparatus comprising: first and second plication bands, each said plication band comprising: first and second legs each having a first end, said first ends of said first and second legs having a tissue piercing configuration; and a bridge having first and second ends, said first end of said bridge being connected to said first leg and said second end of said bridge being connected to said second leg such that said first ends of said first and second legs are separated by a first given distance; said bridge being configured such that when said first ends of said first and second legs have pierced tissue at said first given distance, said bridge may be deformed so as to cause said first ends of said first and second legs to move toward one another so as to thereafter be separated by a second, shorter given distance, whereby said first and second legs gather together the pierced tissue to effect a desired geometric change in the annulus of the heart valve; and a linking construct connected to said first and second plication bands; deploying said first plication band in tissue; tensioning said linkage construct; deploying said second plication band in tissue; and releasing the tension on said linkage construct, whereupon said linkage construct will further reduce the circumference of the annulus of the heart valve.

22. A method for reducing the circumference of the annulus of a heart valve, said method comprising the steps of: providing apparatus for effecting a desired geometric change in the annulus of a heart valve, said apparatus comprising: first and second plication bands, each said plication band comprising: first and second legs each having a first end, said first ends of said first and second legs having a tissue piercing configuration; and a bridge having first and second ends, said first end of said bridge being connected to said first leg and said second end of said bridge being connected to said second leg such that said first ends of said first and second legs are separated by a first given distance; said bridge being configured such that when said first ends of said first and second legs have pierced tissue at said first given distance, said bridge may be deformed so as to cause said first ends of said first and second legs to move toward one another so as to thereafter be separated by a second, shorter given distance, whereby said first and second legs gather together the pierced tissue to effect a desired geometric change in the annulus of the heart valve; and a linking construct connected to said first and second plication bands; deploying said first plication band in tissue, and deploying said second plication band in tissue; and deforming said linkage construct so as to draw said first and second plication bands together so as to further reduce the circumference of the annulus of the heart valve.

23. A method for reducing the circumference of the annulus of a heart valve, said method comprising the steps of: providing apparatus for effecting a desired geometric change in the annulus of a heart valve, said apparatus comprising: a plication band comprising: first and second legs each having a first end, said first ends of said first and second legs having a tissue piercing configuration; and a bridge having first and second ends, said first end of said bridge being connected to said first leg and said second end of said bridge being connected to said second leg such that said first ends of said first and second legs are separated by a first given distance; said bridge being configured such that when said first ends of said first and second legs have pierced tissue at said first given distance, said bridge may be deformed so as to cause said first ends of said first and second legs to move toward one another so as to thereafter be separated by a second, shorter given distance, whereby said first and second legs gather together the pierced tissue to effect a desired geometric change in the annulus of the heart valve; positioning said plication band in said left atrium of the heart; and deploying said plication band into said annulus of the heart valve so as to reduce the circumference of the annulus of the heart valve.

24. A method for effecting a desired geometric change in the annulus of a heart valve, said method comprising the steps of: providing apparatus for effecting a desired geometric change in the annulus of a heart valve, said apparatus comprising: a plication band comprising: first and second legs each having a first end, said first ends of said first and second legs having a tissue piercing configuration; and a bridge having first and second ends, said first end of said first bridge being connected to said first leg and said second end of said bridge being connected to said second leg such that said first ends of said first and

second legs are separated by first given distance; said bridge being configured such that when said first ends of said first and second legs have pierced tissue at said first given distance, said bridge may be deformed so as to cause said first ends of said first and second legs to move toward one another so as to thereafter be separated by a second, shorter given distance, whereby said first and second legs gather together the pierced tissue to effect a desired geometric change in the annulus of the heart valve; positioning said plication band in a vascular structure of the heart; and deploying said plication band into the side wall of the vascular structure so as to effect a desired geometric change in said annulus of the heart valve.

25. A method according to claim 24 wherein said vascular structure comprises at least one of the coronary sinus and the great cardiac vein.

26. A method for effecting a desired geometric change in the annulus of a heart valve, said method comprising the steps of: providing apparatus for effecting a desired geometric change in the annulus of a heart valve, said apparatus comprising: a plication band comprising: first and second legs each having a first end, said first ends of said first and second legs having a tissue piercing configuration; and a bridge having first and second ends, said first end of said bridge being connected to said first leg and said second end of said bridge being connected to said second leg such that said first ends of said first and second legs are separated by a first given distance; said bridge being configured such that when said first ends of said first and second legs have pierced tissue at said first given distance, said bridge may be deformed so as to cause said first ends of said first and second legs to move toward one another so as to thereafter be separated by a second, shorter given distance, whereby said first and second legs gather together the pierced tissue to effect a desired geometric change in the annulus of the heart valve; positioning said plication band against an outside surface of the heart; and deploying said plication band into the outside surface of the heart so as to effect a desired geometric change in said annulus of the heart valve.

27. A method according to claim 26 wherein said apparatus is incorporated into a cardiac restraint device for reducing the dilatation of the heart.

Description

REFERENCE TO PENDING PRIOR PATENT APPLICATION

[0001] This patent application claims benefit of pending prior U.S. Provisional Patent Application Ser. No. 60/213,782, filed Jun. 23, 2000 for AUTOMATED ANNULAR PLICATION FOR MITRAL VALVE REPAIR, which patent application is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] Mitral valve repair is the procedure of choice to correct mitral regurgitation of all etiologies. With the use of current surgical techniques, between approximately 70% and 95% of regurgitant mitral valves can be repaired. The advantages of mitral valve repair over mitral valve replacement are well-documented. These include better preservation of cardiac function and reduced risk of anticoagulant-related hemorrhage, thromboembolism and endocarditis.

[0003] Nearly all mitral valve repairs include an annuloplasty. The annuloplasty consists of a suture or prosthetic ring that surrounds all or part of the circumference of the annulus of the mitral valve. The annuloplasty serves several functions: it remodels the annulus of the valve; it decreases tension on suture